

## FALSEWORK STABILITY

In a stable bent with more than two falsework posts, the post reactions are proportional to their distances from the center of rotation, and may be obtained by algebraic summation.

### 5-1.06 Pony Bent Systems

The stability of pony bent systems should be given special consideration. Pony bents should be independently braced, and the bracing must be capable of resisting the overturning moment produced by the horizontal design load acting at the top of the pony bent.

Pony bents are usually erected on and supported by a platform constructed at the top of the primary load-carrying members.

The platform functions as a horizontal diaphragm, and thus stabilizes the entire falsework system.

If a stabilizing platform is not incorporated into the falsework design, the individual bents must be braced or tied together in some manner to prevent lateral displacement at the bottom of the pony bent system.

### 5-1.07 Multiple & Built up Cap Systems

Multiple cap systems are inherently less stable than single cap systems. Similarly, cap systems that are poorly constructed by utilizing an excessive amount of built-up material between the supporting foundation and cap beam are more vulnerable to stability problems.

When investigating the stability of a multiple cap system, it is important to remember that the stability of the system will decrease as the distance between the supporting members and the top of the cap/sill beam increases. Cap and sill beam assemblies (as defined below) should adhere to a maximum height to width ratio of 2:1 unless the falsework designer determines that a more conservative approach is needed. In addition, multiple layers of supporting material must be equal or greater in width than the previous layer, hence forcing a pyramid shape. These requirements are illustrated in the following Figures 5-5, 5-6 and 5-7.

The following cap/sill beam definitions shall be used for purposes of checking the **2:1 ratio**.

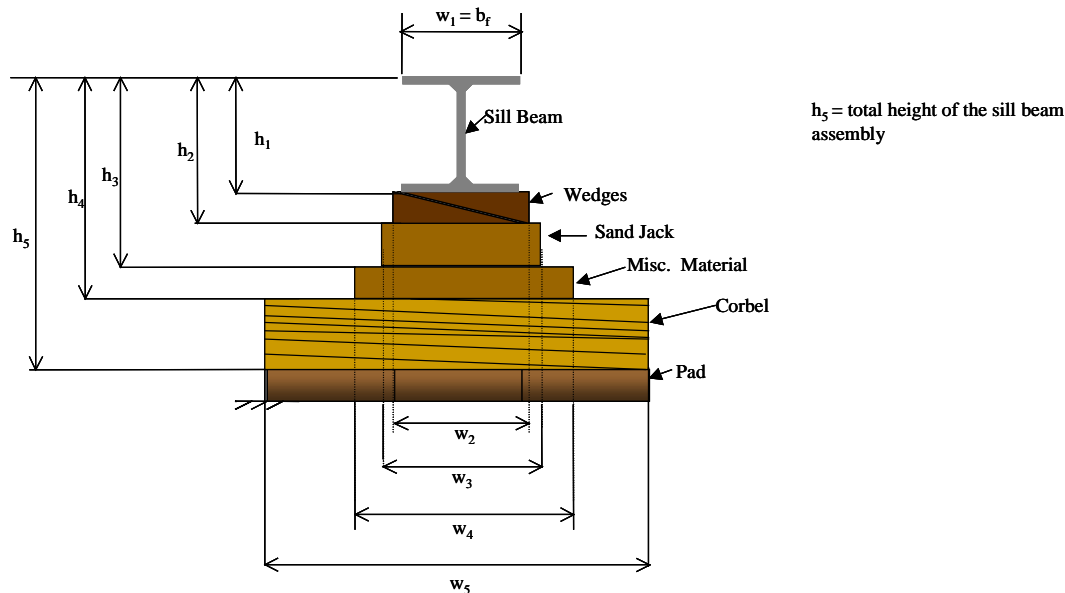
In the overturning direction **perpendicular to the centerline** of the falsework bent, a sill beam assembly shall include all material from the **top**

flange of the sill beam to the top of the pad (See Figures 5-5 and 5-6). A cap beam assembly shall include all the material from the **top** flange of the cap beam to the top of the post.

In the overturning direction **parallel to the centerline** of the falsework bent, a sill beam assembly shall include all material from the **bottom** flange of the sill beam to the top of the pad (See Figure 5-7). A cap beam assembly shall include all the material from the **bottom** flange of the cap beam to the top of the supporting member (e.g. post).

The 2:1 height to width criteria shall be strictly enforced during both falsework plan review and construction phases. Often multiple capping or excessive stacking of material is done to correct grade errors discovered during falsework construction. This is an unacceptable construction practice and shall not be allowed.

On occasion a situation may arise where the falsework designer chooses to engineer a cap/sill assembly that does not meet the 2:1 height to width criteria. In general cap/sill assemblies that do not meet the 2:1 ratio should be strongly discouraged and alternatives should be explored. However, the 2:1 criteria may be exceeded if the falsework cap/sill assembly is externally stabilized. The external stabilizing support system must be designed to withstand the greater of the horizontal wind or construction load or a minimum 2% of the falsework dead load force (similar to the longitudinal stability analysis) applied to the top of the upper most cap/sill beam. In addition, the stabilizing support system must be designed to accommodate both grading adjustments and bent settlement without inducing additional horizontal loads into the cap system.

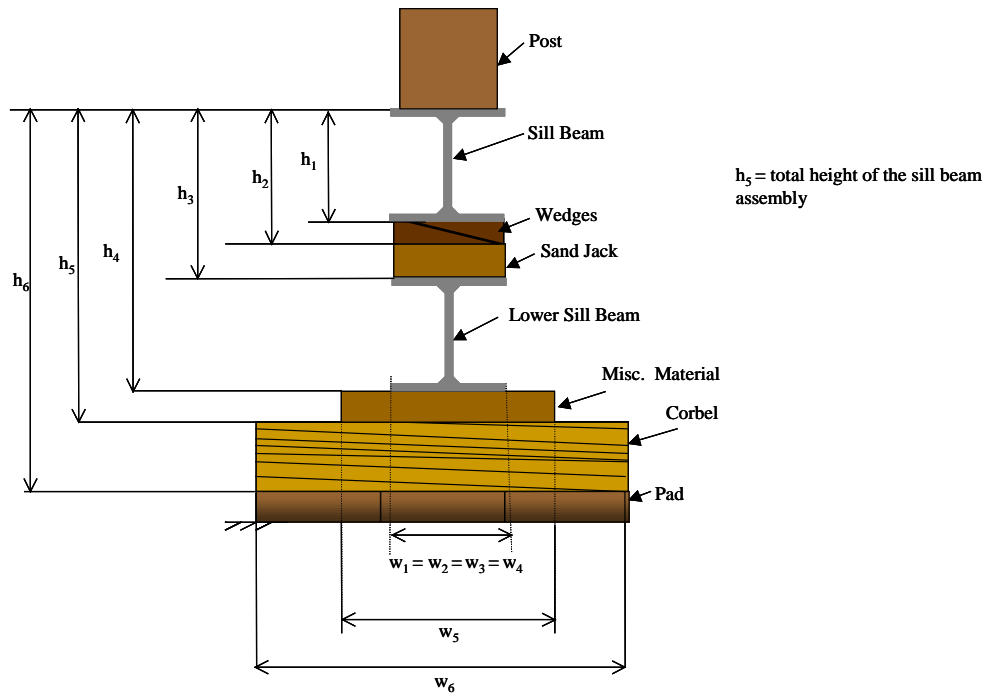


Stability Requirement (Overturning direction perpendicular to the falsework bent)

$$h_i \leq 2w_i \quad (w_i \geq w_{(i-1)} \geq b_f)$$

Figure 5-5

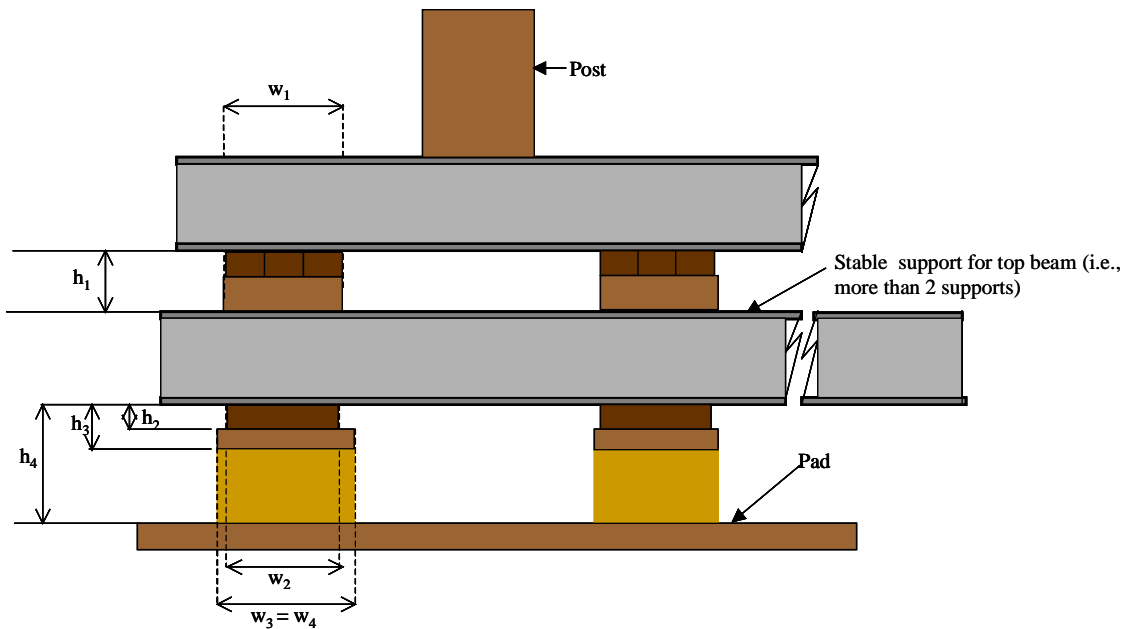
## Falsework Stability



Stability Requirement (Overturning direction perpendicular to the falsework bent)

$$h_i \leq 2w_i \quad (w_i \geq w_{(i-1)} \geq b_f)$$

Figure 5-6



Stability Requirement (Overturning direction parallel to the falsework bent)

$$h_i \leq 2w_i$$

Figure 5-7

5 – 1.08 Combining Stresses

As noted elsewhere in this manual, stresses produced by the simultaneous application of horizontal and vertical forces need be combined only in those situations where bending must be considered to prevent overstressing of an axially-loaded member of the falsework system. Examples of such situations will include pile bents over water where the bracing extends only to the water surface and multi-tiered frame bents where the bracing system, although adequate to resist the collapsing force, does not fully support the vertical members in the bent and/or cannot prevent side sway.

The ability of a falsework member to resist the combined effect of bending and axial compression is evaluated by the combined stress expression. The combined *stress* expression, or interaction formula as it is sometimes called, establishes a limiting relationship between bending and compressive stresses such that the sum of the actual/allowable ratios of the two stresses may not exceed 1. In formula form the combined stress expression is:

$$f_b/F_b + f_c/F_c \leq 1$$

Where  $f_b$  and  $f_c$  are the calculated bending and compressive stresses, respectively, and  $F_b$  and  $F_c$  are the allowable values for bending and axial compression as listed in the specifications.

The combined stress expression may be used to determine the adequacy of falsework members to resist bending and axial compression in all cases except driven timber piles. Timber piles should be evaluated in accordance with the procedures discussed in Chapter 7.